

PRE-OPERATIONAL  
TERRESTRIAL STUDIES  
in the vicinity of  
HEMLO AREA GOLD MINES,  
1984

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PRE-OPERATIONAL TERRESTRIAL STUDIES  
in the vicinity of  
HEMLO AREA GOLD MINES  
1984

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## INTRODUCTION

Development of three gold mines began in 1984 near Hemlo, on the north shore of Lake Superior. These mines, owned by Lac Minerals Limited, Noranda Mines Limited, and the Teck-Corona Operating Group, are situated on Highway 17, 50 kilometres east of Marathon, Ontario. The three companies are operating in the same ore body, which contains 0.18 to 0.36 ounces of gold per tonne of ore. Teck-Corona and Noranda began milling ore in the spring of 1985, while Lac Minerals began in December, 1985. All mines use essentially the same ore treatment process. The ore is crushed, ground, leached with cyanide, then passed through a carbon adsorption circuit before the gold is refined. Molybdenum may be a future by-product of the gold extraction process.

The discharge of significant amounts of air pollutants from the Hemlo operations is considered unlikely. However, to ensure that this assumption is correct, a vegetation and soil sampling study was conducted. Baseline sampling of tree foliage, moss, lichens and soil was undertaken in May, 1984, to obtain background data before the scheduled start-up of mining activities.

## METHODS

Selection of sampling sites (Figure 1) was based on accessibility, distance from the mines, and presence of suitable vegetation. Following standard Ministry procedures (1), samples were collected of one- and two-year-old white or black spruce foliage, moss (Pleurozium schreberi), lichens (Usnea sp. and Evernia mesomorpha) and two depths of soil (0-5, 5-10 centimetres). Two control sites, remote from the mines, were sampled in addition to the 14 sites near the mines. All samples were analysed for a range of indicators of possible contamination from the mining operations. These indicators were aluminum, antimony, arsenic, barium, cadmium, copper, iron, mercury, molybdenum,

titanium, vanadium and zinc. In addition, organic matter and pH were determined for soil samples.

Coniferous vegetation in the study area was examined for visible evidence of stress caused by diseases, insects, contaminants or physiological factors. The time of year was unsuitable for an assessment of deciduous tree and shrub foliage.

Contaminant guidelines recently developed by the Ministry for vegetation and soil are used in this report. Their exceedence suggests that contamination may be present, but does not necessarily imply adverse effects.

## RESULTS

### TREE FOLIAGE, MOSS AND LICHENS

Coniferous trees in the survey area were found to be free of significant foliar damage attributable to insects or diseases. There was no evidence of air pollution effects.

Chemical analysis results are summarized in Table 1. All parameters were within expected background ranges, typical of vegetation in areas remote from pollution sources.

### SOIL

Analytical results for soil are summarized in Table 2. Average levels of most parameters were higher in surface than in subsurface soil. The reverse was true for iron, titanium and vanadium. Cadmium and pH levels were similar in surface and subsurface layers. Contaminant guidelines were not exceeded at any site.

SUMMARY

A pre-operational survey conducted in May, 1984 at the Hemlo gold field found that the levels of all potential contaminants in vegetation and soil were within normal background ranges. The data acquired from this survey will be used as a benchmark against which results from the operational phase will be compared. A survey representing normal mining operations is presently scheduled for the summer of 1986.

REFERENCES

1. Ontario Ministry of the Environment, 1983. Field investigation procedures manual. Phytotoxicology Section, Air Resources Branch.

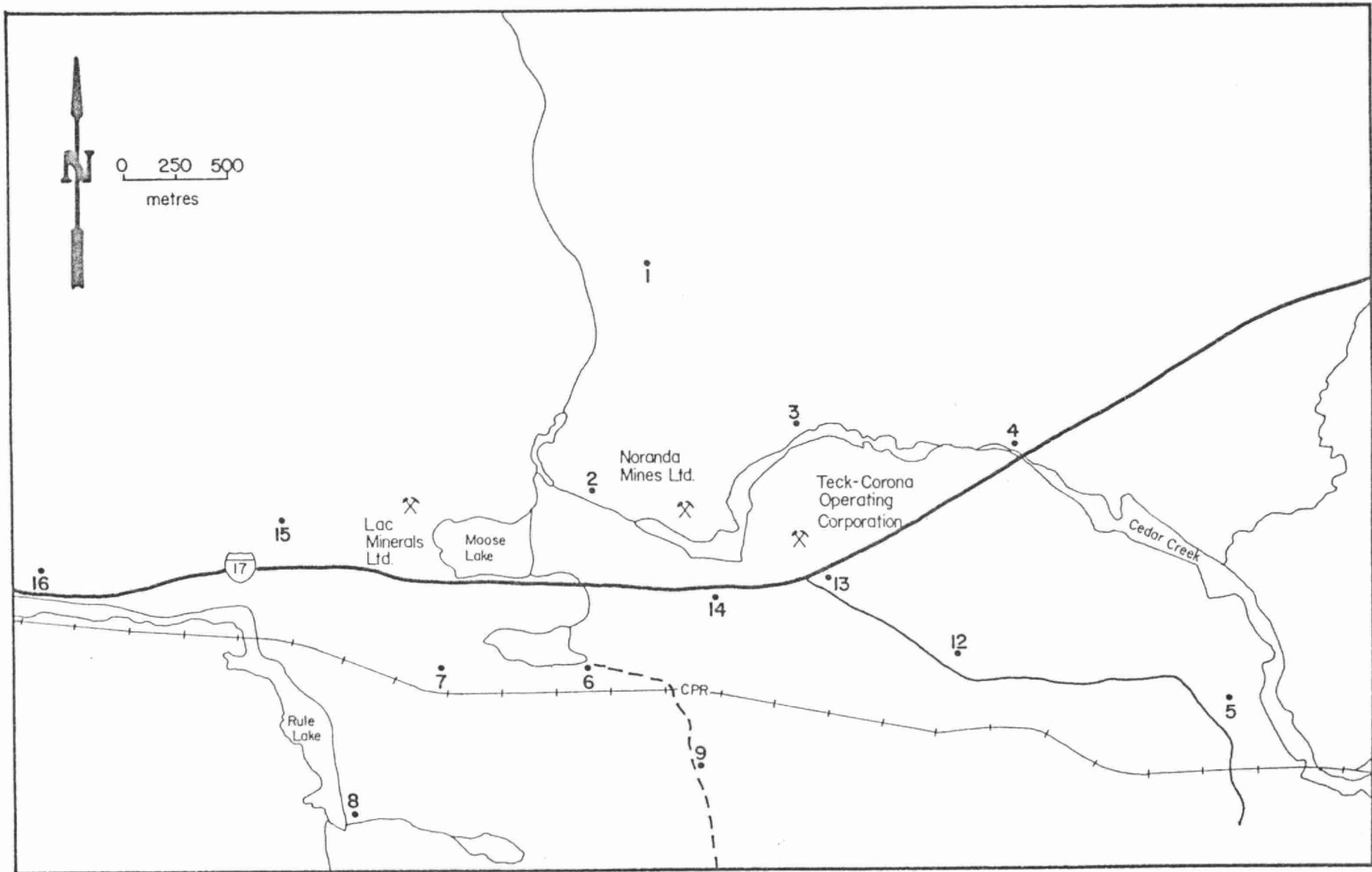


Figure 1. Vegetation and soil sampling sites, Hemlo, May 28-30, 1984.

TABLE 1. Concentrations of selected elements in vegetation near the Hemlo gold field, 1984. All values are in  $\mu\text{g/g}$ , dry weight.

Plant species	Mean and range	Element <sup>a</sup>											
		Al	Sb	As	Ba	Cd	Cu	Fe	Hg	Mo	Ti	V	Zn
Black spruce (1-year old)	Maximum	100	<0.03	0.10	130	<0.5	4.0	110	0.04	0.8	9	1.0	86
	Mean	65	<0.03	<0.10	74	<0.5	2.8	75	0.03	<0.5	5	<1.0	41
	Minimum	35	<0.03	<0.10	30	<0.5	1.1	53	0.02	<0.5	3	<1.0	22
	Std. dev. <sup>b</sup>	19	0	0.02	34	0.0	1.0	19	0.01	0.2	2	0.2	21
Black spruce	Maximum	170	<0.03	0.10	110	<0.5	4.0	190	0.06	0.8	11	1.0	130
	Mean	110	<0.03	<0.10	70	<0.5	2.6	120	0.03	<0.5	7	<1.0	54
	Minimum	42	<0.03	<0.10	31	<0.5	1.2	56	<0.01	<0.5	3	<1.0	28
	Std. dev.	49	0	0.02	28	0.0	1.0	47	0.02	0.3	3	0.2	32
White spruce	Maximum	150	0.12	0.10	130	<0.5	3.7	130	0.06	<0.5	9	1.0	61
	Mean	79	0.03	<0.10	84	<0.5	3.0	79	0.03	<0.5	4	<1.0	50
	Minimum	32	<0.03	<0.10	57	<0.5	2.3	44	0.01	<0.5	2	<1.0	39
	Std. dev.	44	0.04	0.02	30	0	0.5	32	0.02	0	2	0.2	10
White spruce	Maximum	180	<0.03	0.13	130	0.5	4.8	210	0.05	0.6	15	1.0	70
	Mean	106	<0.03	<0.10	82	<0.5	3.2	117	0.03	<0.5	6	<1.0	55
	Minimum	36	<0.03	<0.10	40	<0.5	2.0	40	<0.01	<0.5	2	<1.0	44
	Std. dev.	56	0	0.03	28	0.1	1.0	68	0.02	0.1	4	0.2	9
<i>Pleurozium shreberi</i> (feather moss)	Maximum	2100	0.21	0.76	160	0.9	9.6	1300	0.17	2.0	120	4	150
	Mean	1082	0.04	0.49	84	<0.5	6.8	840	0.11	<0.5	66	2	79
	Minimum	490	<0.03	0.30	41	<0.5	4.8	500	<0.01	<0.5	25	1	52
	Std. dev.	492	0.06	0.15	34	0.2	1.5	280	0.05	0.5	29	1	24
<i>Evernia mesomorpha</i> (lichen)	Maximum	1800	0.14	1.00	71	1.3	6.7	1600	0.40	1.0	130	3	80
	Mean	1000	0.03	0.60	32	<0.5	5.1	970	0.26	<0.5	71	2	52
	Minimum	500	<0.03	0.35	10	<0.5	2.7	530	<0.01	<0.5	30	1	32
	Std. dev.	400	0.03	0.23	18	0.3	1.1	390	0.09	0.2	28	1	14

TABLE 1.(Continued)

Plant species	Mean and range	Element											
		Al	Sb	As	Ba	Cd	Cu	Fe	Hg	Mo	Ti	V	Zn
<i>Usnea</i> sp. (Lichen)	Maximum	1100	0.07	0.75	66	1.4	5.7	850	0.33	0.8	64	3.0	110
	Mean	485	<0.03	0.44	32	<0.5	3.5	450	0.25	<0.5	33	1.4	55
	Minimum	180	<0.03	0.18	13	<0.5	2.1	41	0.14	<0.5	17	<1.0	34
	Std. dev.	310	0.01	0.18	14	0.3	1.0	210	0.06	0.2	14	0.9	22

<sup>a</sup>Contaminant guidelines have not yet been developed for coniferous foliage, mosses, or lichens.

<sup>b</sup>Standard deviation of the mean.

TABLE 2. Levels of selected elements, organic matter and pH in two depths of soil near the Hemlo gold field. All values are in  $\mu\text{g/g}$ , dry weight, except organic matter which is reported as percent, dry weight.

	Al	Sb	As	Ba	Cd	Cu	Fe	Hg	Mo	Ti	V	Zn	OM <sup>a</sup>	pH
<b>Soil (0-5 cm)</b>														
Maximum	47000	0.60	6.30	130	1.7	33	12000	0.13	3.0	4800	56	110	84	5.5
Mean	10000	0.16	2.58	76	<0.5	14	5900	0.05	1.6	3400	19	40	26	4.6
Minimum	300	<0.03	0.93	41	<0.5	9	2300	<0.01	<0.5	12	<1	15	7	4.1
Std. dev.	10600	0.16	1.15	28	0.4	6	3000	0.04	0.8	1200	16	25	22	0.4
<b>Soil (5-10 cm)</b>														
Maximum	17000	0.60	4.30	160	2.4	40	18000	0.08	3.0	5100	49	75	80	4.9
Mean	9900	0.08	2.22	42	<0.5	11	9200	0.03	1.4	4100	33	24	11	4.5
Minimum	4400	0.01	0.30	18	<0.5	5	2000	<0.01	<1.0	1800	4	9	2	3.9
Std. dev.	3700	0.15	1.13	36	0.5	9	4900	0.02	1.0	730	14	17	19	0.2
Proposed <sup>b</sup> contaminant guidelines		1	10		3	60	35000	0.15	2 <sup>c</sup>		70	500		

<sup>a</sup>OM = Organic Matter (determined by loss-on-ignition test).

<sup>b</sup>Applies only to 0-5 cm soil.

<sup>c</sup>Provisional guideline estimated from limited results, pending additional data.

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